SEASONAL CHANGES IN THE FATTY ACID PROFILE OF MUSCLE LIPID IN CULTURED MEAGRE (*Argyrosomus regius*)

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INTRODUCTION

Meagre (*Argyrosomus regius*) is a fish species recently introduced in marine fish culture practices with promising results. An important index of quality in farmed fish for human consumption is the amount and profile of fatty acids in the lipids stored in the main edible fraction, the muscle.

Fat content of fish over the various physiological stages of its life cycle is extremely fluctuating. Since it is the most variable factor, the lipid content is the main factor that determines the muscle quality (Konosu, 1992).

Both wild and cultured marine fish are a source of highly unsaturated fatty acids belonging to the *n*-3 family, greatly appreciated as human food due to their beneficial role in the protection against cardiovascular problems and other diseases (Ackman, 1980). The fatty acid composition of farmed fish can be modified by feeding (Lie, 2001).

Higher levels of linoleic acid (18:2*n*-6) in farmed fish and its relative absence in the marine environment, have been explained by the presence of 18:2*n*-6 coming from vegetal oils in the food. The presence of 22:1*n*-11 in much larger quantities in some farmed fish (Grigorakis *et al.*, 2002) has been justified by the presence in the diet of fish oil from the North Atlantic (Henderson and Tocher, 1987).

Figure 1:

Cage-based fish farm (Algeciras Bay, South of Spain).

Figure 2:

Meagre (Argyrosomus regius)

MATERIAL AND METHODS

Juvenile meagre were sampled at intervals during their first year of stay in a cage-based fish farm (Algeciras Bay, South of Spain).

SAMPLING POINT	DATE	DAYS OF CULTURE
1	Jun-07	0
2	Jul-07	33
3	Aug-07	62
4	Oct-07	119
5	Dec-07	167
6	Mar-08	258
7	Apr-08	307
8	May-08	340

MUSCLE ANALYSES (n=5):

-Muscle composition (AOAC, 2000): Protein, Fat, Moisture, Ash

- Lipid extraction (Folch et al., 1957) and fatty acid analyses (Lepage and Roy, 1984).

INDEXES OF LIPID QUALITY

- **INDEX OF ATHEROGENICITY (IA)** = $\frac{\text{Saturates (14:0, 16:0 and 18:0)}}{n\text{-3 PUFAS (EPA y DHA)}}$
- **FLESH-LIPID QUALITY (FLQ)**= $\frac{n\text{-3 PUFAS (EPA y DHA)}}{\text{TOTAL LIPIDS}}$
- **INDEX OF THROMBOGENICITY (IT)** = $\frac{\text{Saturates (14:0, 16:0 and 18:0)}}{\text{MUFAS, } n\text{-3 PUFAS y } n\text{-6 PUFAS}}$

RESULTS AND DISCUSSION

Analytical data (Fig. 3) shows that saturated and monounsaturated fatty acids (SFAs and MUFAs respectively) represent approximately 30% each of total muscle lipids at the beginning, reaching total polyunsaturated ones (PUFAs) a figure close to 40%. Among these, the most abundant were those of the *n*-3 series while *n*-7 were the more scarce, being intermediate the levels of both *n*-6 and *n*-9 series.
SFA, MUFA and PUFA levels were studied all through several months. During the whole period, total *n*-3 PUFA muscle content decreased as *n*-6 PUFA increased (as a consequence, *n*-3/*n*-6 ratio decreased). All these changes trended to reproduce in fish muscle the fatty acid pattern of the commercial food used. So, it seems that an interaction among dietary and environmental factors (mainly temperature) was in operation, during the studied period, for determining the fatty acid profile of cultured meagre muscle.

Indexes of lipid quality (Fig. 4) got worse in September, reflected by a significant increase in the atherogenic index (IA) and thrombogenic index (IT) and decreased flesh-lipid quality index (FLQ) and the *n*-3/*n*-6 ratio. The following month there was a change in this trend , decreasing the IA and IT, and increasing FLQ, although the ratio *n*-3/*n*-6 remains in low values until the end of the experiment.

When comparing the fatty acid content of fish muscle and the supplied by the feed (Fig. 5), it can be observed that there is generally high levels of saturated fatty acid and *n*-3 PUFAs in most of the analyzed samples, and low levels of *n*-6 PUFAs, which produced a significant increase in the *n*-3/*n*-6 ratio. This is particularly remarkable for the fatty acids eicosapentaenoic (EPA, 20:5 *n*-3) and docosahexaenoic acid (DHA, 22:6 *n*-3), which play an important role in the health of consumers.

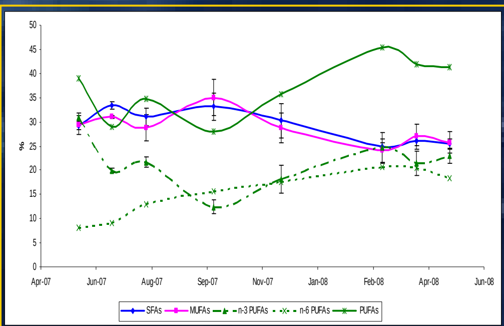

Figure 3:

Temporal evolution of the groups of fatty acids in the muscle of meagre.

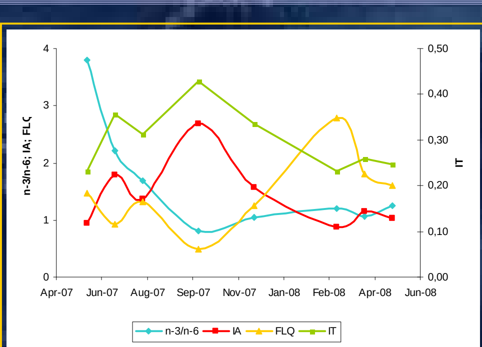

Figure 4:

Temporal evolution of the indexes of lipid quality in the muscle of meagre

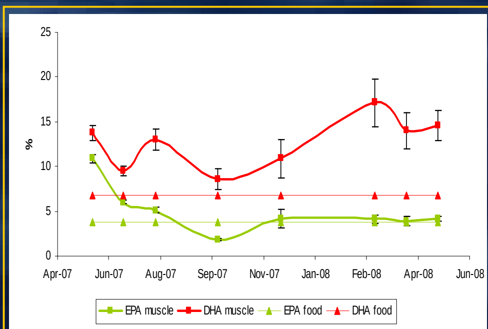

Figure 5:

Temporal evolution of EPA and DHA contents in food and muscle of meagre.

REFERENCES

. **Ackman,RG.1980**. Fish lipids. Part 1. In: Connell JJ (ed.) Advances in fish science and technology. Fishing News Books Ltd, Farnham, UK, p 86-103.
. **Grigorakis, K., Alexis, M.N., Taylor, K.D.A., Hole, M., 2002**. Comparison of wild and cultured gilthead sea bream; composition, appearance and seasonal alterations. *Int. J. Food Sci. Technol.* 37, 477-484.
. **Henderson, R.J., Tocher, D.R., 1987**. The lipid composition and biochemistry of freshwater fish. *Prog. Lipid Res.* 26, 281-347.
. **Konosu, S. 1994**. Colour and taste Spiny-Lobster-Management. Phillips,-B.F.;Cobb,-J.S.;Kittaka,-J.-Eds. London-Uk Blackwell-Scientific-Publications pp. 495-502.
. **Lie, O. 2001**. Flesh quality - the role of nutrition. *Aquaculture Research* 32: 341-348.
. Folch, J., Lees, M., Stanley G.H.S. (1956). A simple method for the isolation and purification of total lipides from animal tissues. J. Biol. Chem., 226: 497 - 509.
. Lepage, G. and Roy, C. C. (1984). Improved recovery of fatty acid through direct transesterification without prior extraction or purification. *J. Lipid Res.* 25: 1391 - 1396.

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